CROSBY-ON-EDEN SCHOOL

“Enjoying achieving; achieving enjoyment”

CALCULATIONS POLICY

UNDER REVIEW

Due to our new Maths scheme, Power Maths, this Policy is under review until the Spring Term 2019 – if you have any questions about this, please see your child’s class teacher. Thank you.

Date Policy adopted by Governors	**October 2016**
Review date	**October 2018**
Review schedule	**Biennial**
Review responsibility	**Learning & Teaching Sub-Committee**
Signed (Head)	**Signed (Chair of Governors)**

Review Schedule

Revisions made	By Whom	Date

Crosby on Eden C E Primary School

Calculations Policy

The following pages show the different calculation strategies which we will be teaching in school.

As with all areas of the curriculum, the methods change depending on the level of understanding.

Your child will be working with the most suitable method for them at their stage of development, this may not always be what is suggested for their year group.

If you have any questions about the calculation strategies used then please speak to the class teacher or Mrs Ord.

MENTAL CALCULATIONS

Addition

These are a **selection** of mental calculation strategies:

Mental recall of number bonds

6 + 4 = 10 ▪ + 3 = 10

25 + 75 = 100 19 + ▪ = 20

Use near doubles

6 + 7 = double 6 + 1 = 13

Addition using partitioning and recombining

34 + 45 = (30 + 40) + (4 + 5) = 79

Counting on or back in repeated steps of 1, 10, 100, 1000

86 + 57 = 143 (by counting on in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Add the nearest multiple of 10, 100 and 1000 and adjust

24 + 19 = 24 + 20 – 1 = 43

458 + 71 = 458 + 70 + 1 = 529

Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

55 – 19 = 36 55 – 36 = 19

To add 10, 100 and 1000 to any given number

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

MENTAL CALCULATIONS

Subtraction

MENTAL CALCULATIONS

These are a selection of mental calculation strategies:

Mental recall of addition and subtraction facts

10 – 6 = 4 **17 - ▪ = 11**

20 - 17 = 3 **10 - ▪ = 2**

Find a small difference by counting up

82 – 79 = 3

Counting on or back in repeated steps of 1, 10, 100, 1000

86 - 52 = 34 (by counting back in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 - 19 = 24 - 20 + 1 = 5

458 - 71 = 458 - 70 - 1 = 387

Use the relationship between addition and subtraction

36 + 19 = 55 **19 + 36 = 55**

55 – 19 = 36 **55 – 36 = 19**

To add 10, 100 and 1000 to any given number

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

MENTAL CALCULATIONS

Multiplication and division

These are a selection of mental calculation strategies:

Doubling and halving

Applying the knowledge of doubles and halves to known facts.

e.g. 8 x 4 is double 4 x 4

Knowing that halving is dividing by 2

Using multiplication and division facts

Year 2 **2 times table**

5 times table

10 times table

Year 3 **2 times table**

3 times table

4 times table

5 times table

8 times table

10 times table

Year 4, 5 and 6 Derive and recall all multiplication and division facts up to 12 x 12 and use the terminology 'inverse'.

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know 3 x 7 = 21, what else do I know?

30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Use closely related facts already known

13 x 11 = (13 x 10) + (13 x 1)

= 130 + 13

= 143

Multiplying and dividing by 10, 100 and 1000

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left. Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

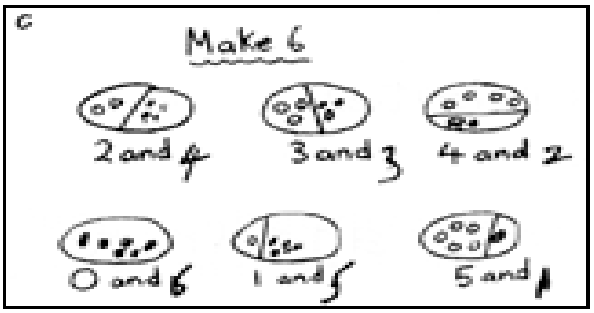
Use of factors

8 x 12 = 8 x 4 x 3

Addition

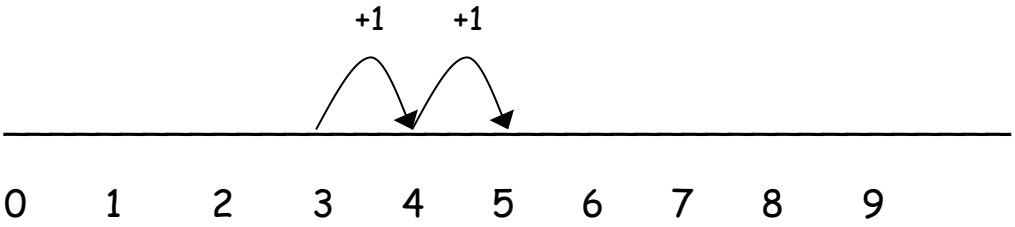
YR and Y1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



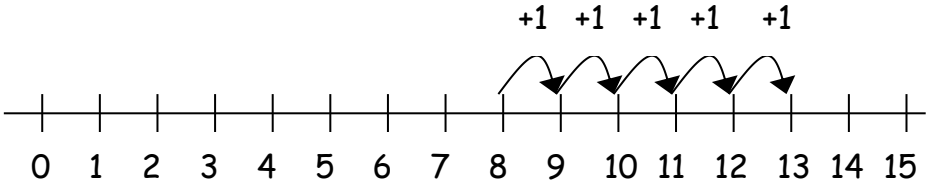
They use numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5

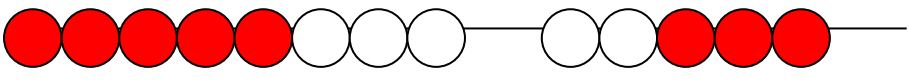


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3 (as they are arranged in groups of 5's).

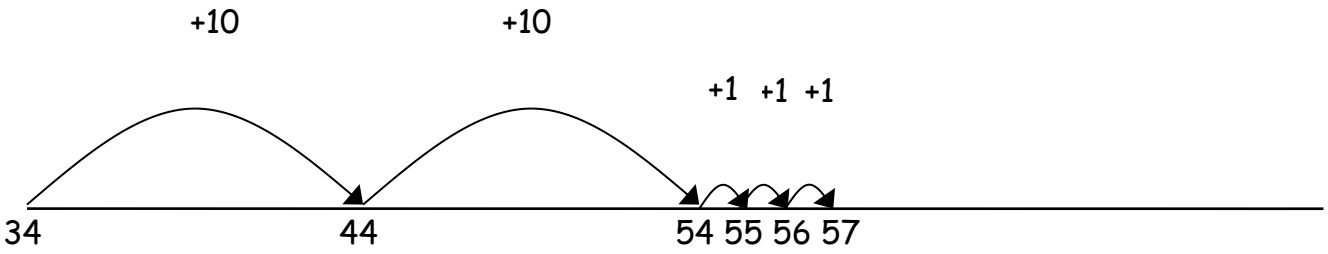


Y2+Y3

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

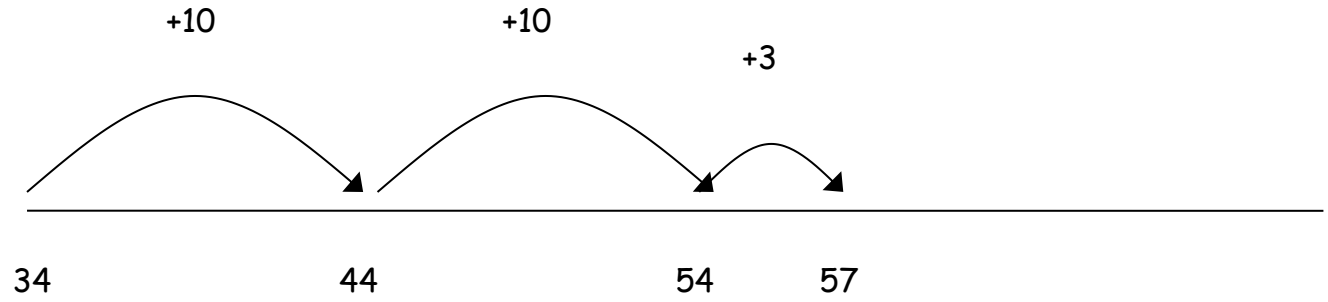
- ✓ First counting on in tens and ones.

34 + 23 = 57



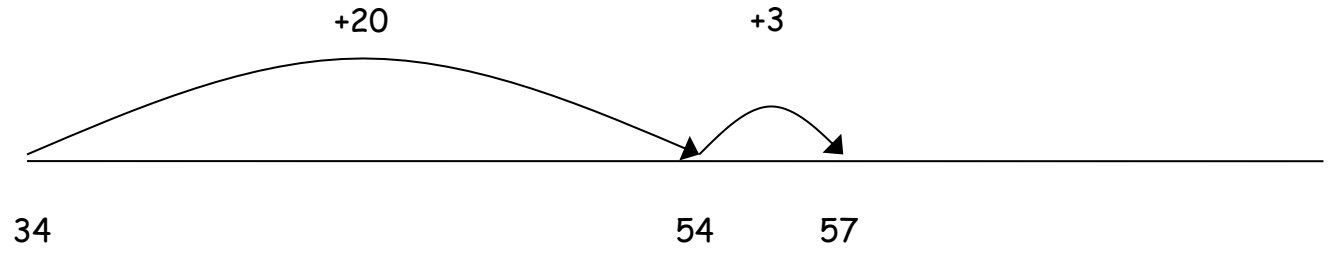
- ✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



- ✓ Followed by adding the tens in one jump and the units in one jump.

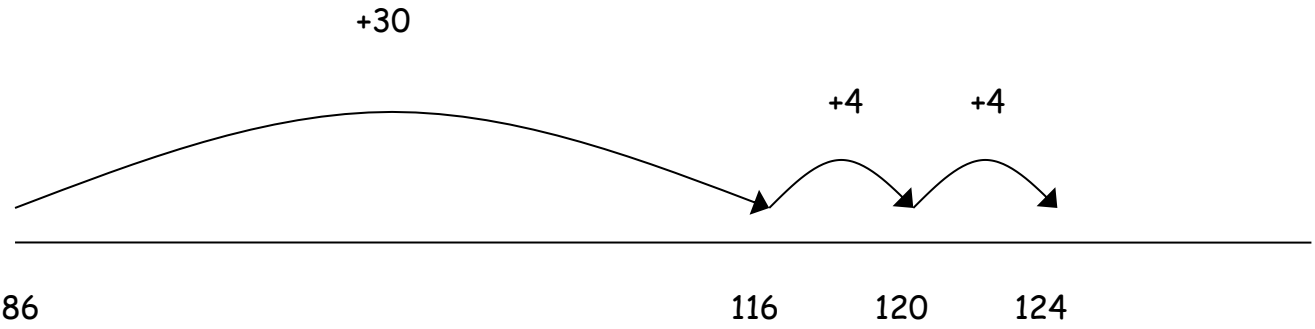
34 + 23 = 57



Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate.

✓ Count on from the largest number irrespective of the order of the calculation.

38 + 86 = 124



Column Method for addition (adding the units first-the least significant digit)

67	267
+ 24	+ 85
11 (7 + 4)	12 (7 + 5)
80 (60 + 20)	140 (60 + 80)
91	200
	352

Y4

Continuation of the column method (as shown above) but dealing with 3, 4 and 5 digit numbers and introducing decimals.

Y5 +Y6

From this, children will begin to carry above or below the line.

625	783	367
+ 48	+ 42	+ 85
673	825	452
1	1	1 1

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- ✓ *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.*
- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m – 280 cm.*

Children should extend the carrying method to number with any number of digits.

7648	6584	42
+ 1486	+ 5848	6432
9134	12432	786
1 1 1	1 1 1	3
		+ 4681
		11944
		1 2 1

Using similar methods, children will

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to four digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 401.2 + 26.85 + 0.71.*

\+ - + - + - + - + - + - +

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

- **they are not ready.**
- **they are not confident.**

Children should be encouraged to approximate their answers before calculating.

Children should be encouraged to check their answers after calculation using an appropriate strategy.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

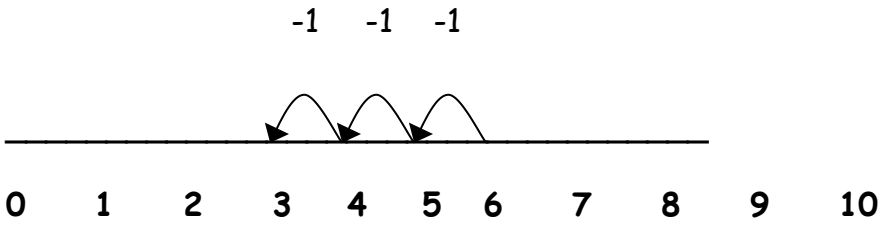
Subtraction

YR and Y1

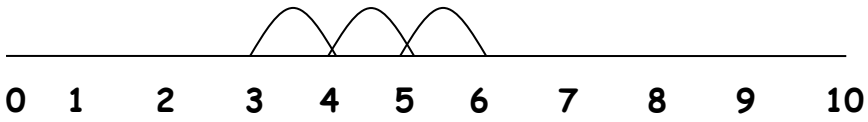
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

They use numberlines and practical resources to support calculation. Teachers *demonstrate* the use of the numberline.

6 – 3 = 3

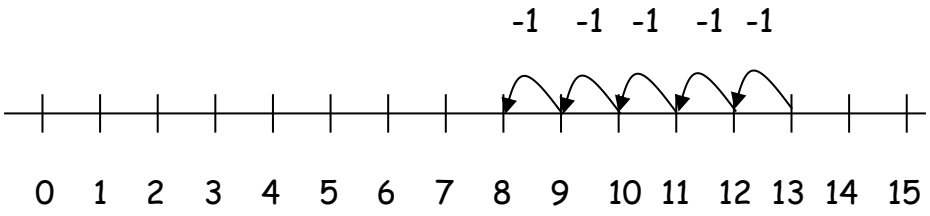


The numberline should also be used to show that 6 – 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 – 5 = 8



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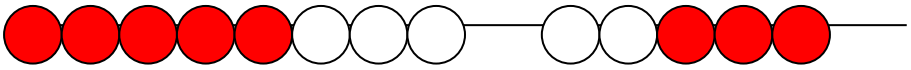
13 – 5 = 8



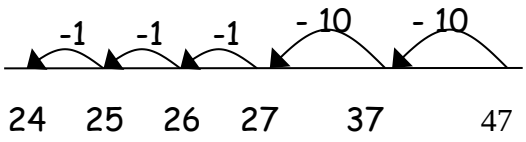
Y2+3

Children will begin to use empty number lines to support calculations.

Counting back

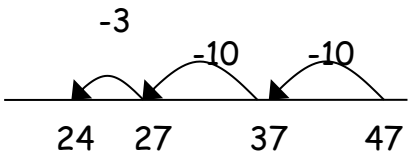
- ✓ **First counting back in tens and ones.**

47 – 23 = 24



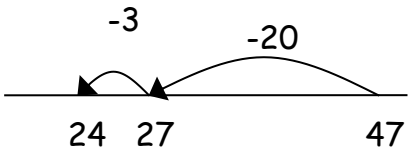
- ✓ **Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).**

47 – 23 = 24



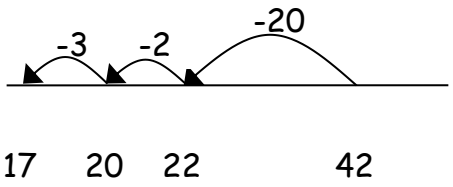
- ✓ **Subtracting the tens in one jump and the units in one jump.**

47 – 23 = 24



- ✓ **Bridging through ten can help children become more efficient.**

42 – 25 = 17



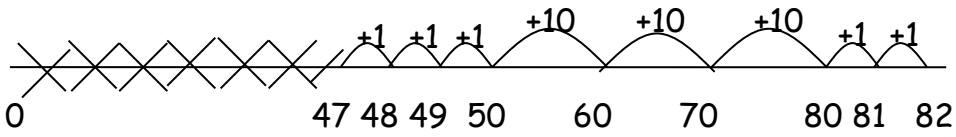
Counting on

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on.

Count up from 47 to 82 in jumps of 10 and jumps of 1.

The number line should still show 0 so children can cross out the section from 0 to the smallest number. They then associate this method with 'taking away'.

82 - 47



Help children to become more efficient with counting on by:

- ✓ **Adding the units in one jump;**
- ✓ **Adding the tens in one jump and the units in one jump;**
- ✓ **Bridging through ten.**

Formal written methods

Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

Partitioning and decomposition

This process should be demonstrated using arrow cards to show the partitioning and base 10 materials to show the decomposition of the number.

NOTE When solving the calculation 89 – 57, children should know that 57 does NOT EXIST AS AN AMOUNT it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89.

89	**=**	**80**	**+**	**9**	
- 57		**50**	**+**	**7**	
		30	**+**	**2**	**= 32**

Initially, the children will be taught using examples that do not need the children to exchange.

From this the children will begin to exchange.

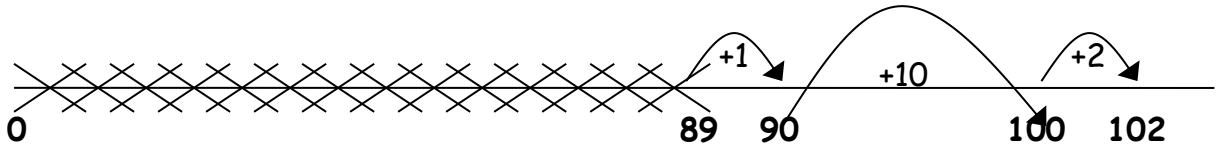
This would be recorded by the children as

$$\begin{array}{rrcl} 71 = & \overset{60}{\cancel{7}}0 & + & {}^{1}1 \\ \underline{-\ 46} = & \underline{40} & + & \underline{6} \\ & 20 & + & 5 \quad = \ 25 \end{array}$$

Children should know that units line up under units, tens under tens, and so on.

Where the numbers involved in the calculation are close together or near to multiples of 10, 100 (eg money and time problems) etc counting on using a number line should be used.

102 – 89 = 13



Y4

The children will continue to develop formal written methods for subtraction.

754 =

- 86

This would be recorded by the children as

$$\begin{array}{rrcl} & \overset{600}{\cancel{7}}00 & + & \overset{140}{\cancel{5}}0 + {}^{1}4 \\ - & & & \underline{80 + 6} \\ & 600 & + & 60 + 8 \quad = \quad 668 \end{array}$$

Step 1

$$\begin{array}{rrcl} & 700 & + & 50 + 4 \\ - & & & \underline{80 + 6} \end{array}$$

Step 2

$$\begin{array}{rrcl} & 700 & + & 40 + 14 \\ - & & & \underline{80 + 6} \end{array}$$

(adjust from T to U)

Step 3

		600	+	140	+	14	*(adjust from H to T)*
	-			80	+	6	
		600	+	60	+	8	= 668

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;*
- ✓ *know that decimal points should line up under each other.*

For example:

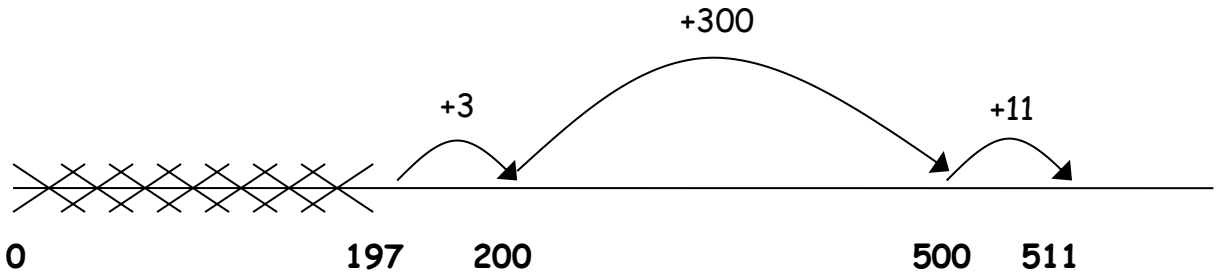
£8.95	=	8	+	0.9	+	0.05		leading to
-£4.38	-	4	+	0.3	+	0.08		
								1
8.85	=	8	+	0.8	+	0.15		*(adjust from T to U)*
- 4.38	-	4	+	0.3	+	0.08		
		4	+	0.5	+	0.07		= £4.57

Alternatively, children can set the amounts to whole numbers, i.e. 895 – 438 and convert to pounds after the calculation.

NB If your children have reached the concise stage they will then continue this method through into years 5 and 6. They will not go back to using the expanded methods.

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line should be used.

511 – 197 = 314



Y5+6

Decomposition

```
  614 1
   754
 - 286
   468
```

```
  5 13 1
   6467
 - 2684
   3783
```

```
  3 1
   4207
 -  3735
    472
```

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other.*

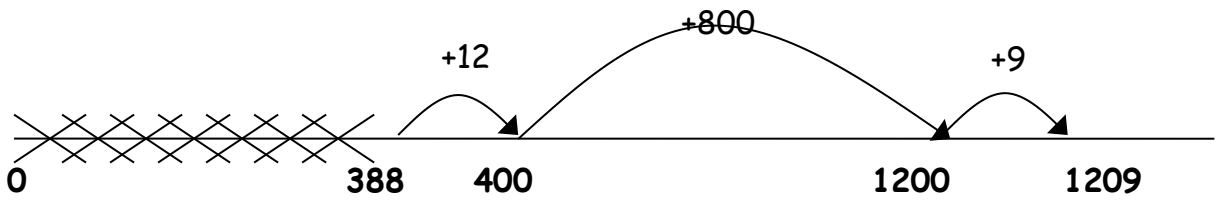
£8.95	=	8	+	0.9	+	0.05	
-£4.38	= -	4	+	0.3	+	0.08	

8.95	=	8	+	0.8	+	0.15	*(adjust from T to U)*
- 4.38	= -	4	+	0.3	+	0.08	
		4	+	0.5	+	0.07	= £4.57

8.90	=	8	+	0.8	+	0.10	*(adjust from T to U)*
- 4.38	= -	4	+	0.3	+	0.08	
		4	+	0.5	+	0.02	= £4.52

Where the numbers involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line could be used.

1209 – 388 = 821

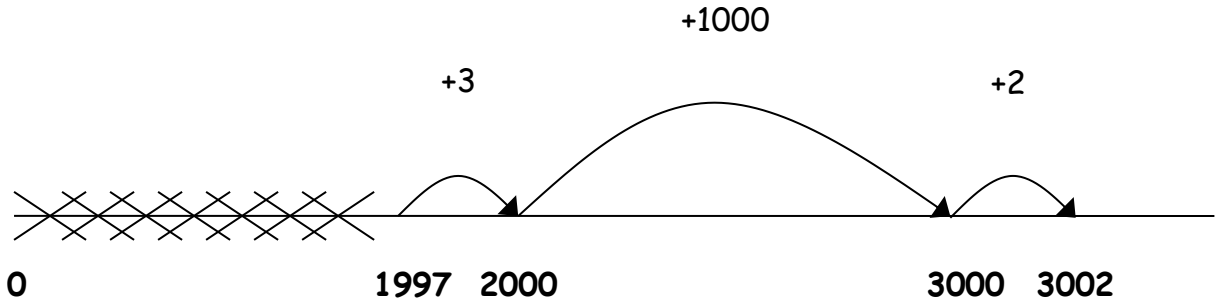


Children should:

- ✓ ***be able to subtract numbers with different numbers of digits;***
- ✓ ***be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places;***
- ✓ ***know that decimal points should line up under each other.***

Where the numbers involved in the calculation are close together or near to multiples of 10, 100 etc counting on using a number line could still be used.

3002 – 1997 = 1005



By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

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- **they are not ready.**
- **they are not confident.**

Children should be encouraged to approximate their answers before calculating.

Children should be encouraged to check their answers after calculation using an appropriate strategy.

Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

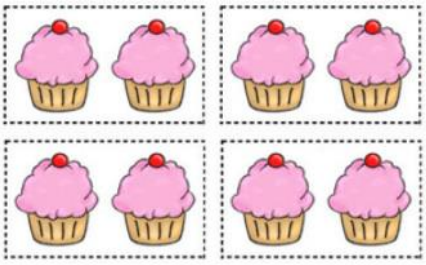
Multiplication

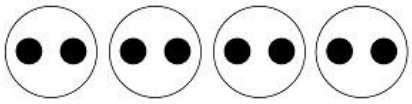
The following are standards that we expect the majority of children to achieve.

YR and Y1

Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s.They will work on practical problem solving activities involving equal sets or groups.

4 groups of 2 =8





4 groups of 2
or 2 + 2 + 2 + 2
or 4 x 2

Y2

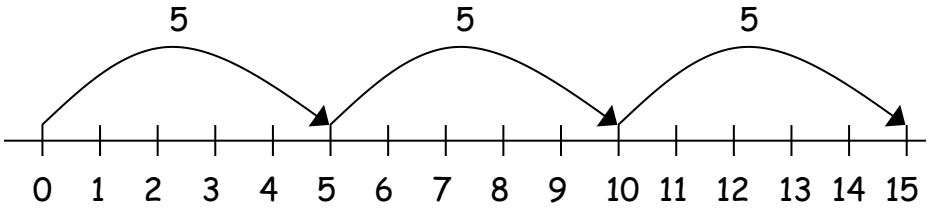
Children will develop their understanding of multiplication and use jottings to support calculation:

- ✓ **Repeated addition**

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3

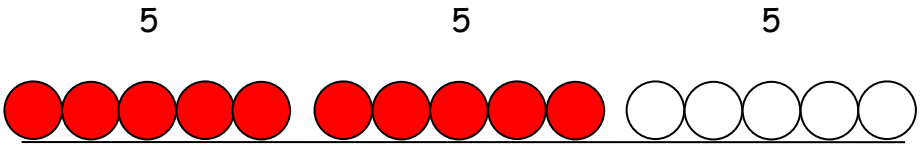
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5



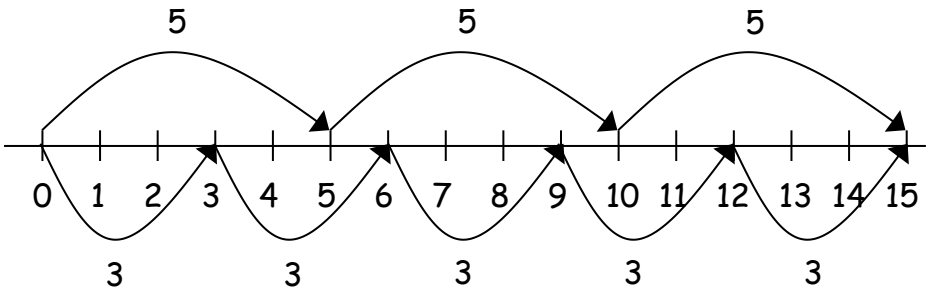
and on a bead bar:

5 x 3 = 5 + 5 + 5



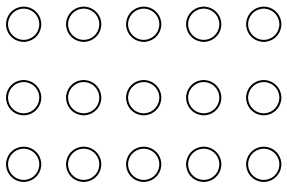
✓ **Commutativity**

Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line.



✓ **Arrays**

Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



5 x 3 = 15

3 x 5 = 15

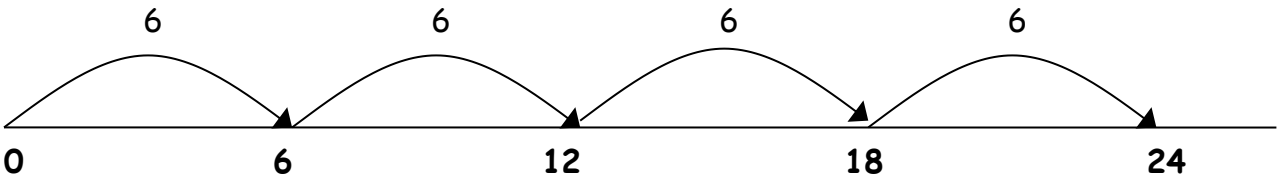
Y3

Children will continue to use:

✓ **Repeated addition**

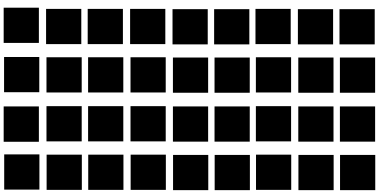
4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4

Children should use number lines or bead bars to support their understanding.



Arrays

Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



9 x 4 = 36

4 x 9 = 36

Children will also develop an understanding of

✓ **Scaling**

e.g. Find a ribbon that is 4 times as long as the blue ribbon

5 cm **20 cm**

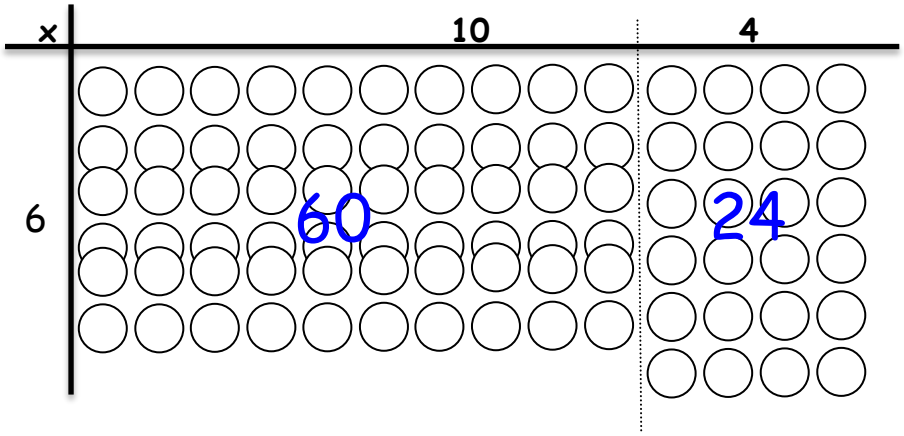
✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

▪ x 5 = 20 **3 x ☺ = 18** **▪ x ▪ = 30**

✓ **Partitioning**

38 x 5 = (30 x 5) + (8 x 5)
= 150 + 40
= 190

When ready children will use awareness of arrays where appropriate leading into the grid method of multiplication.



(6 x 10) + (6 x 4)

60 + 24

84

Grid method

TU x U

23 x 8

x	20	3
8	160	24

160
+ 24
184

Children will approximate first

23 x 8 is approximately 25 x 8 = 200

HTU x U)

346 x 9

Children will approximate first

346 x 9 is approximately

350x 10 = 3500

x	300	40	6
9	2700	360	54

2700
+ 360
+ 54
3114

If children are ready they will progress to multiplying HTUxU. HTUxTU and HTUxHTU (as seen below)

HTUxTU

372 x 24

Children will approximate first

372 x 24 is approximately 400 x 25 = 10000

x	300	70	2
20	6000	1400	40
4	1200	280	8

6000
+ 1400
+ 1200
+ 280
+ 40
+ 8
8928
1

Y4

Children will begin to use formal written methods of short multiplication for (TUxU and HTUxU)

Short Multiplication TUxU

24 × 6 becomes

	2	**4**
×		**6**
1	**4**	**4**
	2	

Answer: 144

HTUxU

342 × 7 becomes

	3	**4**	**2**
×			**7**
2	**3**	**9**	**4**
	2	1	

Answer: 2394

Y5+6

Children are taught formal written methods for long and short multiplication.

For long multiplication children can do the tens or the units first depending on which method they are familiar with.

Short multiplication

24 × 6 becomes

```
  2 4
×   6
-----
  1 4 4
    2
```

Answer: 144

342 × 7 becomes

```
  3 4 2
×     7
-------
  2 3 9 4
    2 1
```

Answer: 2394

2741 × 6 becomes

```
  2 7 4 1
×       6
---------
  1 6 4 4 6
    4 2
```

Answer: 16 446

Long multiplication

24 × 16 becomes

```
    2
  2 4
× 1 6
-----
2 4 0
1 4 4
-----
3 8 4
-----
```

Answer: 384

124 × 26 becomes

```
    1 2
  1 2 4
×   2 6
-------
  7 4 4
2 4 8 0
-------
3 2 2 4
-------
1 1
```

Answer: 3224

When using decimals

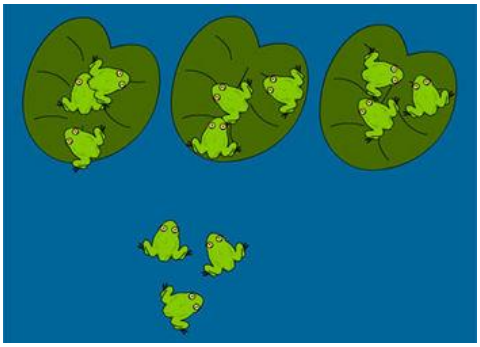
```
  3.45
X    3
------
 10.35
------
 1 1
```

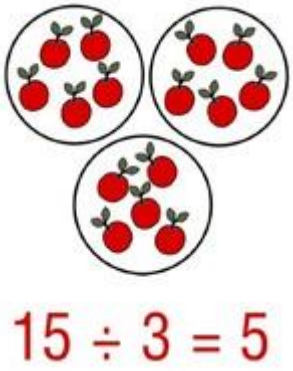
Division

YR and Y1

Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

Sharing out the 12 frogs onto the lily pads





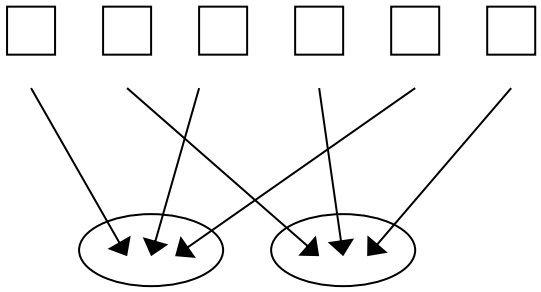
or

Y2

Children will develop their understanding of division and use jottings to support calculation

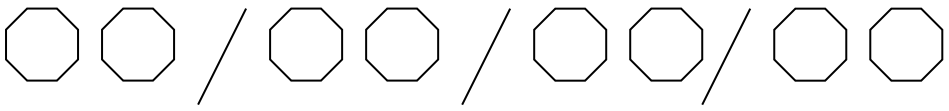
- ✓ **Sharing equally**

6 sweets shared between 2 people, how many do they each get?



- ✓ **Grouping or repeated subtraction**

There are 8 sweets, how many people can have 2 sweets each?



Y3

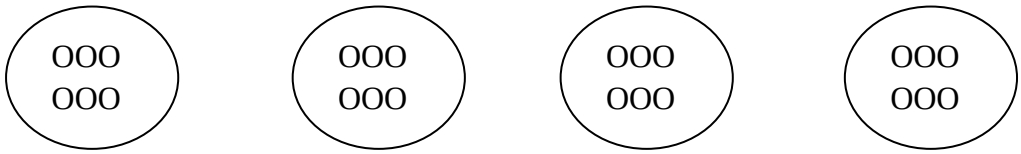
Children will use:

- ✓ **A number line**

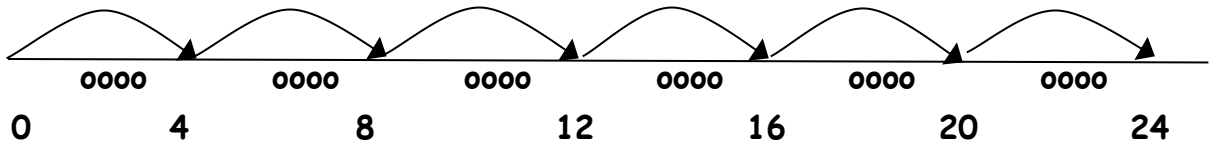
Children will continue to use the concept of sharing but will begin to transfer this onto a numberline.

24 ÷ 4 = 6

Step 1: sharing 24 counters into 4 groups



Step 2: Each time a counter is given to each of the 4 groups then it is marked on a numberline as a group of 4, those 4 counters are also marked on.

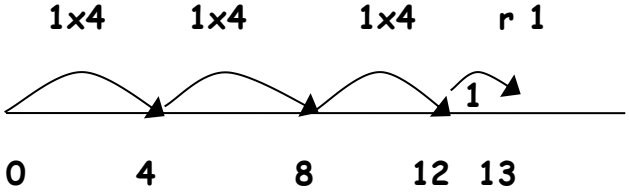


Step 3: Children will learn that each group of 4 means 1 for each group therefore 24 ÷ 4 = 6

Following these stages, when the child is ready, they will no longer need to show the groups and will only use the numberline.

- ✓ **Children should also move onto calculations involving remainders. They will draw the remaining amount as counters until secure with the concept.**

13 ÷ 4 = 3 r 1



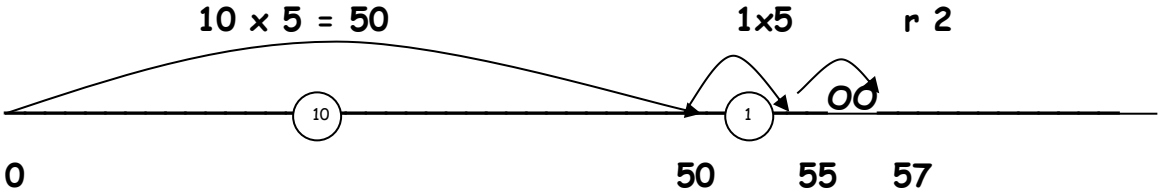
- ✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

26 ÷ 2 = ▪ 24 ÷ ☺ = 12 ▪ ÷ 10 = 8

Children will develop their use of number lines to count on in multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s – numbers with which the children are more familiar.

57 ÷ 5

Moving onto:



Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 62 ÷ 8 is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

e.g. I have 62p. Sweets are 8p each. How many can I buy?

Answer: 7 (the remaining 6p is not enough to buy another sweet)

Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?

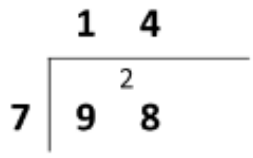
Answer: 8 (the remaining 6 apples still need to be placed into a box)

Y4

Children will begin to use formal written methods of short division for (TU÷U and possiby HTU÷U)

TU÷U (no remainders)

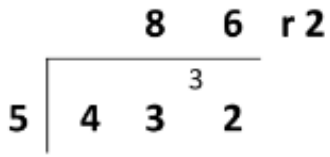
98 ÷ 7 becomes



Answer: 14

HTU÷U (with remainders)

432 ÷ 5 becomes



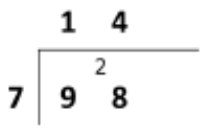
Answer: 86 remainder 2

Y5+6

Children are taught formal written methods for long and short division.

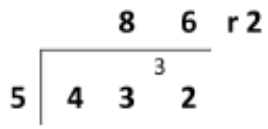
Short division

98 ÷ 7 becomes



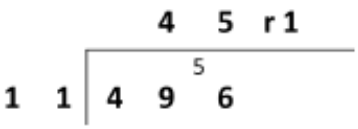
Answer: 14

432 ÷ 5 becomes



Answer: 86 remainder 2

496 ÷ 11 becomes



Answer: $45\frac{1}{11}$

Long division

432 ÷ 15 becomes

$$
\begin{array}{rr|lll}
 & & 2 & 8 & \text{r } 12 \\
\hline
1 & 5 & 4 & 3 & 2 \\
 & & 3 & 0 & 0 \\
\hline
 & & 1 & 3 & 2 \\
 & & 1 & 2 & 0 \\
\hline
 & & & 1 & 2
\end{array}
$$

Answer: 28 remainder 12

432 ÷ 15 becomes

$$
\begin{array}{rr|lll}
 & & 2 & 8 & \\
\hline
1 & 5 & 4 & 3 & 2 \\
 & & 3 & 0 & 0 \quad 15\times20 \\
\hline
 & & 1 & 3 & 2 \\
 & & 1 & 2 & 0 \quad 15\times8 \\
\hline
 & & & 1 & 2
\end{array}
$$

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\ \frac{4}{5}$